

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (canceled)

1 Claim 2 (currently amended): The method of claim 11 ±
2 wherein the path is a label-switched path.

1 Claim 3 (currently amended): The method of claim 11 ±
2 wherein the message is a resource reservation protocol PATH
3 message.

1 Claim 4 (currently amended): A method for processing, by a
2 node of a network, a message carrying at least one network
3 path determination constraint, the method comprising:

4 a) performing a constraint-based path determination
5 to a next node selected from a group of nodes
6 consisting of

7 (i) an area border node,

8 (ii) an autonomous system gateway node,

9 (iii) a node that can process one of the at least

10 one network path determination constraint carried

11 by the message which the present node cannot, or

12 will not, evaluate,

13 (iv) a specified loose-hop node, and

14 (v) a node to which constraint processing is

15 delegated,

16 to generate a partial path; and

17 b) forwarding the message carrying the at least one

18 network path determination constraint to an adjacent

19 downstream node on the partial path, or to a delegated

20 node that is able to carry out the path determination,

21 ~~The method of claim 1~~ wherein the at least one network path
22 determination constraint includes at least two constraints
23 selected from a group of constraints consisting of:

- 24 - link type
- 25 - minimum link bandwidth,
- 26 - minimum reservable link bandwidth,
- 27 - maximum current bandwidth reservation,
- 28 - maximum current bandwidth usage,
- 29 - link coloring,
- 30 - link administrative group,
- 31 - link delay,
- 32 - link media type,
- 33 - end-to-end path minimum bandwidth,
- 34 - end-to-end path maximum number of hops,
- 35 - end-to-end path minimum priority,
- 36 - optical link wavelength,
- 37 - optical link minimum signal to noise ratio,
- 38 - optical link maximum power dispersion,
- 39 - optical link transmission power,
- 40 - optical link receiver sensitivity,
- 41 - node type,
- 42 - minimum node throughput,
- 43 - node quality of service support, and
- 44 - node queuing type.

1 Claim 5 (currently amended): A method for processing, by a
2 node of a network, a message carrying at least one network
3 path determination constraint, the method comprising:

- 4 a) performing a constraint-based path determination
- 5 to a next node to generate a partial path; and

6 b) forwarding the message carrying the at least one
7 network path determination constraint to an adjacent
8 downstream node on the partial path,

9 wherein each of the at least one network path
10 determination constraint is an executable instruction.

1 Claim 6 (currently amended): A network node comprising:

2 a) a path determination facility for performing a
3 constraint-based path determination to a next node to
4 generate a partial path; and

5 b) a signaling facility for

6 i) receiving a message carrying at least one
7 network path determination constraint, and

8 ii) forwarding the message carrying the at least
9 one network path determination constraint to an
10 adjacent downstream node on the partial path,
11 wherein each of the at least one network path
12 determination constraint is an executable instruction.

1 Claim 7 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:

4 a) performing a constraint-based path determination
5 to a next node selected from a group of nodes
6 consisting of

7 (i) an area border node,

8 (ii) an autonomous system gateway node,

9 (iii) a node that can process one of the at least
10 one network path determination constraint carried
11 by the message which the present node cannot, or
12 will not, evaluate,

13 (iv) a specified loose-hop node, and

14 (v) a node to which constraint processing is
15 delegated,
16 to generate a partial path; and
17 b) forwarding the message carrying the at least one
18 network path determination constraint to an adjacent
19 downstream node on the partial path, or to a delegated
20 node that is able to carry out the path determination,
21 ~~The method of claim 1~~ wherein the at least one network path
22 determination constraint includes at least one constraint
23 selected from a group of constraints consisting of:
24 - node type,
25 - minimum node throughput,
26 - node quality of service support, and
27 - node queuing type.

1 Claim 8 (currently amended): The method of claim 11 ~~1~~
2 wherein the at least one network path determination
3 constraint includes a list of at least one explicit node
4 specified to be a part of the path.

1 Claim 9 (original): The method of claim 8 wherein the list
2 of at least one explicit node specified to be a part of the
3 path identifies at least one of a strict-hop node and a
4 loose-hop node.

1 Claim 10 (original): The method of claim 8 wherein the
2 message forwarded to the adjacent downstream node on the
3 partial path includes an updated list, and
4 wherein the node maintains the initial instance
5 of the list, as received.

1 Claim 11 (currently amended): A method for processing, by
2 a node of a network, a message carrying at least one
3 network path determination constraint, the method
4 comprising:

5 a) performing a constraint-based path determination
6 to a next node selected from a group of nodes
7 consisting of

8 (i) an area border node,

9 (ii) an autonomous system gateway node,

10 (iii) a node that can process one of the at least
11 one network path determination constraint carried
12 by the message which the present node cannot, or
13 will not, evaluate,

14 (iv) a specified loose-hop node, and

15 (v) a node to which constraint processing is
16 delegated,

17 to generate a partial path; and

18 b) forwarding the message carrying the at least one
19 network path determination constraint to an adjacent
20 downstream node on the partial path, or to a delegated
21 node that is able to carry out the path determination,

22 ~~The method of claim 1~~ wherein each of the at least one
23 network path determination constraint is an executable
24 instruction.

1 Claim 12 (original): The method of claim 11 wherein each
2 executable instruction includes:

- 3 - information about a first operand;
4 - information about a second operand; and
5 - an operation code.

1 Claim 13 (original): The method of claim 12 wherein the
2 operation code identifies an operation selected from a
3 group of operations consisting of:

- 4 - bit-wise AND;
- 5 - bit-wise OR;
- 6 - bit-wise XOR;
- 7 - bit-wise equality;
- 8 - bit-wise inversion;
- 9 - Boolean AND;
- 10 - Boolean OR; and
- 11 - Boolean negation.

1 Claim 14 (original): The method of claim 12 wherein the
2 information about either of the first operand or the second
3 operand is a pointer to a register.

1 Claim 15 (original): The method of claim 14 wherein the
2 register is a register which contains a link attribute.

1 Claim 16 (original): The method of claim 14 wherein the
2 register is a read-only register.

1 Claim 17 (currently amended): The method of claim 11 ~~4~~
2 further comprising:
3 - generating a list which specifies nodes on the
4 partial path as strict hop nodes; and
5 - forwarding the list to an adjacent downstream node
6 on the partial path.

1 Claim 18 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:

4 a) determining whether the node is a tail-end node, a
5 head-end node, or an intermediate node of the path;
6 b) if it is determined that the node is a tail-end
7 node and each of the at least on network path
8 determination constraint has been satisfied, then
9 signaling back to an upstream node of the path that
10 the path is OK;
11 c) if it is determined that the node is one of a
12 head-end node and an intermediate node, then
13 i) determining whether (a) a strict-hop node is
14 specified as a next node of an explicit path
15 constraint, (b) a loose-hop node is specified as
16 a next node of an explicit path constraint, or
17 (c) no node is specified as an explicit path
18 constraint,
19 ii) if a strict-hop node is specified as a next
20 node of an explicit path constraint, then
21 A) applying each of the at least one
22 network path determination constraint to an
23 appropriate one of a link between the node
24 and the strict-hop node, the strict-hop
25 node, and the partial path defined,
26 B) if each of the at least one constraint
27 is satisfied, then forwarding a message
28 carrying the at least one network path
29 determination constraint to the strict-hop
30 node, and
31 C) if any one of the at least one
32 constraint was not satisfied, then signaling
33 a path error back to an upstream node,
34 iii) if one of (a) a loose hop node is specified
35 as a next node of an explicit path constraint or

36 (b) no node is specified as an explicit path
37 constraint, then
38 A) performing a constraint-based path
39 determination to a next node selected from a
40 group of nodes consisting of
41 (1) an area border node,
42 (2) an autonomous system gateway node,
43 (3) a node that can process one of the
44 at least one network path determination
45 constraint carried by the message which
46 the present node cannot, or is
47 unwilling to, evaluate,
48 (4) a specified loose-hop node, and
49 (5) a node to which constraint
50 processing is delegated,
51 to generate a partial path, and
52 B) forwarding the message carrying the at
53 least one network path determination
54 constraint to an adjacent downstream
55 node on the partial path.

1 Claim 19 (original): The method of claim 18 wherein the
2 upstream node is the head-end node.

1 Claim 20 (currently amended): A machine-readable medium
2 having stored thereon at least one network path
3 determination constraint expressed as an executable
4 instruction, each executable instruction comprising:
5 - information concerning a first operand;
6 - information concerning a second operand; and
7 - an operation code,

8 wherein the machine-readable medium is a
9 component of a first node of a communications network, and
10 wherein the at least one network path
11 determination constraint expressed as an executable
12 instruction was received in a message from a second node of
13 the communications network.

1 Claim 21 (original): The machine-readable medium of claim
2 20 wherein the operation code denotes an operation selected
3 from a group of operations consisting of:

- 4 - bit-wise AND;
- 5 - bit-wise OR;
- 6 - bit-wise XOR;
- 7 - bit-wise equality;
- 8 - bit-wise inversion;
- 9 - Boolean AND;
- 10 - Boolean OR; and
- 11 - Boolean negation.

1 Claim 22 (original): The machine-readable medium of claim
2 20 wherein the information concerning either of the first
3 operand or the second operand is a pointer to a register.

1 Claim 23 (original): The machine-readable medium of claim
2 22 wherein the register is a register that contains a link
3 attribute.

1 Claim 24 (original): The machine-readable medium of claim
2 22 wherein the link attribute is selected from a group of
3 link attributes consisting of:

- 4 - link type;
- 5 - maximum link bandwidth;

6 - maximum reservable link bandwidth;
7 - current bandwidth reservation;
8 - current bandwidth usage;
9 - link coloring;
10 - link administrative group;
11 - link delay;
12 - link media type;
13 - optical link wavelength;
14 - optical link minimum signal to noise ratio;
15 - optical link maximum power dispersion;
16 - optical link transmission power; and
17 - optical link receiver sensitivity.

1 Claim 25 (original): The machine-readable medium of claim
2 22 wherein the register is a register that contains a node
3 attribute.

1 Claim 26 (original): The machine-readable medium of claim
2 25 wherein the node attribute is selected from a group of
3 node attributes consisting of:
4 - node type;
5 - minimum node throughput;
6 - node quality of service support; and
7 - node queuing type.

1 Claim 27 (original): The machine-readable medium of claim
2 20 having further stored thereon at least one network path
3 determination constraint as a list of at least one explicit
4 node that is specified to be a part of the network path.

1 Claim 28 (original): The machine-readable medium of claim
2 27 wherein the at least one explicit node is one of a
3 loose-hop node and a strict-hop node.

1 Claim 29 (currently amended): A network node comprising:
2 a) a plurality of registers including attribute
3 registers, the attribute registers storing attributes
4 of links in the network; and
5 b) a machine-readable medium having stored thereon
6 at least one network path determination constraint as
7 an executable instruction, each executable instruction
8 including
9 i) a first operand pointer,
10 ii) a second operand pointer, and
11 iii) an operation code,
12 wherein at least one of the first and second
13 operand pointers points to one of the attribute
14 registers, and
15 wherein the executable instruction was
16 received in a message from another network node.

1 Claim 30 (original): The network node of claim 29 wherein
2 the plurality of registers further includes general purpose
3 registers,
4 wherein each of the attribute registers is a
5 read-only register, and
6 wherein each of the general purpose registers is
7 read/write register.

1 Claim 31 (original): The network node of claim 29 wherein
2 the machine-readable medium also has stored thereon at
3 least one network path determination constraint as a list

4 of at least one explicit node that is specified to be a
5 part of the network path.

1 Claim 32 (original): The network node of claim 31 wherein
2 the at least one explicitly specified node is one of a
3 loose-hop node and a strict-hop node.

1 Claim 33 (original): The network node of claim 29 wherein
2 the plurality of registers further include accumulation
3 registers storing cumulative attributes of a path.

1 Claim 34 (currently amended): A machine-readable medium
2 having stored thereon+ a message to be communicated between
3 different network nodes in a communications network, the
4 message comprising:

- 5 a) an executable instruction encoding at least one
6 network path determination constraint; and
- 7 b) a list of at least one explicit node specified to
8 be a part of the path.

1 Claim 35 (original): The machine-readable medium of claim
2 34 wherein the executable instruction includes:

- 3 - information concerning a first operand;
- 4 - information concerning a second operand; and
- 5 - an operation code.

1 Claim 36 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:

- 4 a) if the tail-end node of the path is in a part of
5 the network, the topology of which is not known by the
6 node, then performing a constraint-based path

determination to a next node selected from a group of nodes consisting of

(i) an area border node, and
(ii) an autonomous system gateway node,
to generate a partial path; and

b) forwarding the message carrying the at least one network path determination constraint to an adjacent downstream node on the partial path.

Claim 37 (currently amended): A method for processing, by a node of a network, a message carrying at least one network path determination constraint, the method comprising:

a) if a next node specified in a list of explicit nodes is a loose-hop node, then performing a constraint-based path determination to the next loose-hop node to generate a partial path; and
b) forwarding the message carrying the at least one network path determination constraint to an adjacent downstream node on the partial path,

wherein each of the at least one network path determination constraint is an executable instruction.

Claim 38 (currently amended): A method for processing, by a node of a network, a message carrying at least one network path determination constraint, the method comprising:

a) if the node cannot process any one of the at least one network path determination constraint, performing a constraint-based path determination to a node that can process that one of the at least one network path

9 determination constraint, to generate a partial path;
10 and
11 b) forwarding the message carrying the at least one
12 network path determination constraint to an adjacent
13 downstream node on the partial path,
14 wherein each of the at least one network path
15 determination constraint is an executable instruction.

1 Claim 39 (currently amended): A method for processing, by
2 a node of a network, a message carrying at least one
3 network path determination constraint, the method
4 comprising:
5 a) if constraint processing has been delegated to
6 another network element, performing a constraint-based
7 path determination to the other network element to
8 which constraint processing has been delegated to
9 generate a partial path; and
10 b) forwarding the message carrying the at least one
11 network path determination constraint to an adjacent
12 downstream node on the partial path,
13 wherein each of the at least one network path
14 determination constraint is an executable instruction.

1 Claim 40 (currently amended): A network node comprising:
2 a) a path determination facility for performing a
3 constraint-based path determination to a next node
4 to generate a partial path;
5 b) a signaling facility for
6 i) receiving a message carrying at least one
7 network path determination constraint, and
8 ii) forwarding the message carrying the at
9 least one network path determination constraint

10 to an adjacent downstream node on the partial
11 path;

12 ~~The network node of claim 6, further comprising:~~

13 c) a process for generating a traffic engineering
14 database; and

15 d) a traffic engineering database generated by the
16 processing for generating,
17 wherein the path determination facility is further
18 adapted to determine at least a part of a path based
19 on

20 i) contents of the traffic engineering
21 database, and

22 ii) at least one path constraint received from
23 the signaling facility,

24 wherein, if the path determination facility
25 cannot determine a complete constraint-based path to a
26 specified tail-end node, then the path determination
27 facility performs a constraint-based path determination
28 to a next node selected from a group of nodes consisting
29 of

30 - an area border node,
31 - an autonomous system gateway node,
32 - a node that can process one of the at least
33 one network path determination constraint
34 carried by the message which cannot be
35 evaluated by the present node,
36 - a specified loose-hop node, and
37 - a node to which constraint processing is
38 delegated,

39 to generate a partial path, and

40 the signaling facility forwards a message carrying the at
41 least one path constraint to an adjacent downstream node
42 on the partial path.

1 Claim 41 (original): The routing facility of claim 40
2 wherein the path is a label-switched path.

Claims 42-52 (canceled)

1 Claim 53 (currently amended): The method of claim 5,
2 wherein the node is an intermediary node, and wherein the
3 act of performing a constraint-based path determination
4 includes determining whether a link from the node to the
5 next node specified in a ~~the~~ first portion of the path
6 satisfies the set of at least one constraint.

1 Claim 54 (currently amended): A method for processing,
2 by a node of a network, a message carrying at least one
3 network path determination constraint, the method
4 comprising:
5 a) performing a constraint-based path determination
6 to a next node to generate a partial path;
7 b) forwarding the message carrying the at least one
8 network path determination constraint to an adjacent
9 downstream node on the partial path, wherein the
10 node is an intermediary node, and wherein the act of
11 performing a constraint-based path determination
12 includes determining whether a link from the node to
13 the next node specified in the first portion of the

14 path satisfies the set of at least one constraint;
15 and
16 ~~The method of claim 53, further comprising:~~
17 c) if the link from the first intermediary node to
18 the next node specified in a the first portion of
19 the path is determined to satisfy the set of at
20 least one constraint, then transmitting the received
21 message to the next node.

1 Claim 55 (currently amended): A method for processing,
2 by a node of a network, a message carrying at least one
3 network path determination constraint, the method
4 comprising:

5 a) performing a constraint-based path determination
6 to a next node to generate a partial path;
7 b) forwarding the message carrying the at least one
8 network path determination constraint to an adjacent
9 downstream node on the partial path, wherein the
10 node is an intermediary node, and wherein the act of
11 performing a constraint-based path determination
12 includes determining whether a link from the node to
13 the next node specified in the first portion of the
14 path satisfies the set of at least one constraint;
15 and

16 ~~The method of claim 53, further comprising:~~
17 c) if the link from the first intermediary node to
18 the next node specified in a the first portion of
19 the path is determined not to satisfy the set of at
20 least one constraint, then transmitting an error
21 message back to the source node.

Claim 56 (canceled)

1 Claim 57 (previously presented): The machine-readable
2 medium of claim 35 wherein first operand specifies a
3 memory location in which a value for an attribute of a
4 network node or link is stored, and the second operand
5 represents a constraint value for the attribute, and
6 further comprising:

7 c) a code specifying an operation to be performed
8 on the first operand and second operand; and

9 d) a result portion specifying a memory location in
10 which a result of the operation performed on the
11 first operand and second operand is stored.

Claims 58 and 59 (canceled)

1 Claim 60 (previously presented): The network node of
2 claim 29, wherein the machine-readable medium further
3 stores thereon a table including

4 i) a first entry representing a first
5 attribute of a node or link connected to the
6 node,

7 ii) a second entry representing an accumulated
8 value for a second attribute of a node or link
9 connected to the node, and

10 iii) a third entry storing a result of a
11 specified operation performed on one of the
12 first entry and the second entry.

1 Claim 61 (previously presented): The network node of
2 claim 29, wherein the machine-readable medium further
3 stores thereon a memory data structure including
4 i) a first portion storing attributes of nodes
5 or links in the network,
6 ii) a second portion storing network-path
7 constraints, and
8 iii) a third portion storing instructions for
9 performing operations on the stored attributes
10 and the stored constraints; and further
11 comprising:
12 c) a processor for executing the instructions
13 stored in the third portion of memory and computing
14 a path in the network based on results of the
15 executed instructions.

Claim 62 (canceled)

1 Claim 63 (previously presented): The network node of
2 claim 6 wherein if constraint processing has been
3 delegated to another network element, then the path
4 determination facility further performs a
5 constraint-based path determination to the other network
6 element to which constraint processing has been delegated
7 to generate a partial path.

Claims 64-69 (canceled)

1 Claim 70 (original): A method for processing, by a node of
2 a network, a message carrying at least one network path
3 determination constraint, the method comprising:
4 a) determining whether to delegate constraint
5 processing to another device; and
6 b) if it has been determined that constraint
7 processing has been delegated to another network
8 element, forwarding the message carrying the at least
9 one network path determination constraint to the other
10 device.

1 Claim 71 (new): The method of claim 36 wherein each of the
2 at least one network path determination constraint is an
3 executable instruction.

1 Claim 72 (new): The method of claim 70 wherein each of the
2 at least one network path determination constraint is an
3 executable instruction.

1 Claim 73 (new): The method of claim 4 wherein the path is
2 a label-switched path.

1 Claim 74 (new): The method of claim 4 wherein the message
2 is a resource reservation protocol PATH message.

1 Claim 75 (new): The method of claim 4 wherein at least one
2 of the at least one network path constraint is an
3 executable instruction.

1 Claim 76 (new): The method of claim 7 wherein the path is
2 a label-switched path.

1 Claim 77 (new): The method of claim 7 wherein the message
2 is a resource reservation protocol PATH message.

1 Claim 78 (new): The method of claim 7 wherein at least one
2 of the at least one network path constraint is an
3 executable instruction.